(2)

MAINTAINING MOBILITY ON A HIGH TECH BATTLEFIELD

A Monograph

by

Major John M. Carmichael

Infantry

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

Second Term 88-89

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release: Distribution unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION School of Advanced Military Studies, USAC&GSC 6b. OFFICE SYMBOL (*If applicable*) ATZL-SWV	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (*City, State, and ZIP Code*) Fort Leavenworth, Ks. 66027-6900	7b. ADDRESS (*City, State, and ZIP Code*)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (*If applicable*)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (*City, State, and ZIP Code*)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.
11. TITLE (*Include Security Classification*) MAINTAINING MOBILITY ON A HIGH TECH BATTLEFIELD (U)	
12. PERSONAL AUTHOR(S) Maj John M Carmichael, USA	
13a. TYPE OF REPORT Monograph 13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (*Year, Month, Day*) 89/5/30 15. PAGE COUNT 50
16. SUPPLEMENTARY NOTATION	
17. COSATI CODES FIELD / GROUP / SUB-GROUP	18. SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*) Time-space Tempo Firepower Reconnaissance Destruction Complex Maneuver Leadership Protection Real-Time Intelligence Precision guided Munitions Recon Strike/Fire Complex

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

New technology is making the battlefield increasingly lethal. Precision guided and brilliant munitions linked to real-time and near real-time intelligence is threatening battlefield mobility. Maximizing the capabilities of these new munitions and reconnaissance systems will require an effective command and control structure and doctrine. We must also find ways for maneuver forces to maintain mobility on the battlefield.

This monograph examines the dynamics of combat power with a focus on how mobility, freedom of action, and tempo of operations is achieved or maintained. The impact of modern technology is a key variable in analysis. The monograph uses each of the four elements of combat power --maneuver, firepower, protection, and leadership-- as the framework for discussion. The monograph looks at some techniques to compensate for the changing nature of the battlefield and makes conclusions about how these changes will affect the employment of force.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL Maj John M. Carmichael	22b. TELEPHONE (*Include Area Code*) (913) 684-2138 22c. OFFICE SYMBOL ATZL-SWV

DD Form 1473, JUN 86 *Previous editions are obsolete*

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

Maintaining Mobility on a High Tech Battlefield

by

Major John M. Carmichael

Infantry

School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

15 May 1989

SCHOOL OF ADVANCED MILITARY STUDIES

MONOGRAPH APPROVAL

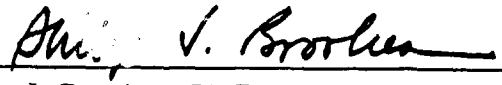
Name of Student: John M. Carmichael, MAJ, Infantry

Title of Monograph: Intelligence, Firepower, and Maneuver: Is the Balance Right?

Approved by:

LTC Thomas A. Hooper, MA — Monograph Director

COL L. D. Holder, MA — Director, School of Advanced Military Studies



Philip J. Brookes, Ph.D. — Director, Graduate Degree Program

Accepted this 15th day of May 1989

ABSTRACT

MAINTAINING MOBILITY ON A HIGH-TECH BATTLEFIELD by Maj John M. Carmichael, USA, 47 pages.

New technology is making the battlefield increasingly lethal. Precision guided and brilliant munitions linked to real-time and near real-time intelligence is threatening battlefield mobility. Maximizing the capabilities of these new munitions and reconnaissance systems will require an effective command and control structure and doctrine. We must also find ways for maneuver forces to maintain mobility on the battlefield.

This monograph examines the dynamics of combat power with a focus on how mobility, freedom of action, and tempo of operations is achieved or maintained. The impact of modern technology is a key variable in analysis. The monograph uses each of the four elements of combat power--maneuver, firepower, protection, and leadership--as the framework for discussion. The monograph looks at some techniques to compensate for the changing nature of the battlefield and makes conclusions about how these changes will affect the employment of force.

TABLE OF CONTENTS

I. INTRODUCTION

The inability to maneuver effectively at the tactical and operational levels can result in the type of deadly attrition that characterized most of World War One in France. New technology is making the battlefield increasingly lethal. Precision guided munitions and brilliant munitions linked to real-time or near real-time intelligence can kill, damage, disrupt or destroy personnel and equipment in shorter periods of time and at greater ranges than ever before. Just as firepower is becoming more lethal and more responsive our maneuver organizations are becoming larger and more unwieldy.

Changes in technology are occurring at an increasingly rapid rate making some systems obsolete shortly after fielding. Understanding the dynamics of combat power and how they shape the nature of the battlefield will help reduce confusion and guide us on the correct path to future weapons development, doctrine, and organization. The dynamics of combat power allow us to think in functions instead of weapons. In an age of increasing technological change when new weapons are constantly developed and improved, thinking in functions will help us maintain the necessary mental flexibility to understand how to accommodate change. We cannot allow our minds to become rigid by thinking in terms of separate arms.[1] The dynamics of combat power are critical since, as FM 100-5, Operations, says they:

> ...decide the outcome of campaigns, major operations, battles, and engagements. Combat power is the ability to fight. It measures the effect created by combining maneuver, firepower, protection, and leadership in combat actions against an enemy in war.[2]

The dynamics of combat power gain their effect from their symbiotic relationship. A force's fighting potential is determined by its ability to combine the dynamics of combat power in the environment in which it is being used. However, as new technology is brought into the force structure in the form of weapons and equipment, the capabilities and relative strength of each of the dynamics may change. The contest between airpower and air defense, armor and anti-armor are examples of these changes.

This paper examines the dynamics of combat power with a focus on how mobility, freedom of action, and tempo of operations is achieved or maintained. The impact of modern technology is a key variable in the analysis. The monograph uses each of the four elements of combat power--firepower, maneuver, protection and leadership--as the framework for discussion. Conclusions about the effectiveness of current doctrine and the changing nature of battle will be developed as a result of the discussion.

II. MANEUVER

> Maneuver is the movement of forces in relation to the enemy to secure or retain positional advantage. It is the dynamic element of combat--the means of concentrating forces at the critical point to achieve the surprise, psychological shock, physical momentum, and moral dominance which enable smaller forces to defeat larger ones.[3]

At the operational level of war "maneuver seeks a decisive impact on the conduct of a campaign. It attempts to gain advantage of position before battle and to exploit tactical successes to achieve operational results." At the tactical level "maneuver seeks to set the terms of combat in a battle or engagement. It is the means of gaining and sustaining the initiative, exploiting success, preserving freedom of action, and reducing the vulnerability of friendly forces. At both levels, effective maneuver is vital to achieving superior combat power."[4]

Maneuver is the dynamic element of combat power. It is the means of achieving a decision. Maneuver combines direction, movement, and mobility in relation to the enemy.[5]

Direction provides an orientation and focus for maneuver of the force. The force must be oriented on objective points of maneuver and decisive points. These provide an orientation for maneuver in the form of an axis of advance and objectives. Direction determines, to a large extent, the positioning of logistics, combat, and combat support units.

It is important to distinguish the difference between maneuver, mobility, and movement.

> Movement is the motion in any direction, for any purpose, by a force of any size. Friendly movement may or may not be influenced by enemy activity or location. As a calculus, it considers the size of the force to be moved, the available means of movement, and the friction imposed by the medium of movement (land, sea, air).[6]

The key factors which comprise mobility at the operational and tactical levels are different. "Soviet writings on operational art include flexibility in deciding when and where to accept battle, speed of mission accomplishment, and the ability to shift directions quickly as fundamental to mobility."[7] The flexibility in deciding when and where to accept battle is "freedom of action". The speed of mission accomplishment is "tempo" and the ability to shift directions quickly is "agility".

At the tactical level mobility is related more to the structure of the instrument than to the conditions in which it is used. According to General Creighton Abrams "There is some confusion as to just what makes mobility in the ground elements of the Army....but mobility, if it is to be effective, is made up of a complex balance of factors. The essential factors of mobility are equipment, organization. communications, command structure, and logistical organization."[8] We will look at some of the elements of tactical mobility as they apply to the structure of the force, as well as the operational aspects of mobility; tempo, agility, and freedom of action.

Combat power is the potential fire and maneuver effect that can be actually applied against an enemy. It is applied in the mediums of space and time. Time, space, and force have a dialectic relationship. To limit this discussion I will restrict the analysis to specific aspects of time, space and force. The issues covered will be: the historical relationship of space and

time, time as it relates to the attack and defense, time as it relates to tempo, and time as it relates to windows of opportunity.

The relationship of time, space, and force has changed over time. In the mid-seventeenth century the range and lethality of weapons were limited. That required forces to be concentrated in space and time. As weapon lethality drove battlefield dispersion, the capability of fire delivery systems had to change. As forces dispersed, weapons had to compensate by increased range and lethality. This caused a fundamental change in the nature of warfare. The change was not easily perceived. In World War One the organization and tactics in France at the beginning and the end of the war were radically different. Initially France and Germany tried to fight a decisive Napoleonic battle on a grand scale. The increased size of armies and their expansion in both space and time prohibited the conditions necessary for such a battle. This change, and others, created the need for an intermediate level between strategy and tactics--operational art.

Tukhachevsky's solution to the expanded battlefield was the use of the simultaneous or "deep" operation. The deep operation was an attempt to achieve the same effect as the Napoleonic battle through a rapid compression of space and time. Mechanization was the key which provided the means to achieve operational compression. Figure 1 shows the Napoleonic battle which was concentrated in space and time, represented by Block A, and the

expanded battlefield of the twentieth century battlefield represented by Block B.

The relatively short range of weapons and maneuver forces could not compensate for the battlefield's expansion in space. The decisive battle could be achieved, however, through the operational compression of time through simultaneous operations in depth. Thus, time became the dominant element of modern operational warfare.

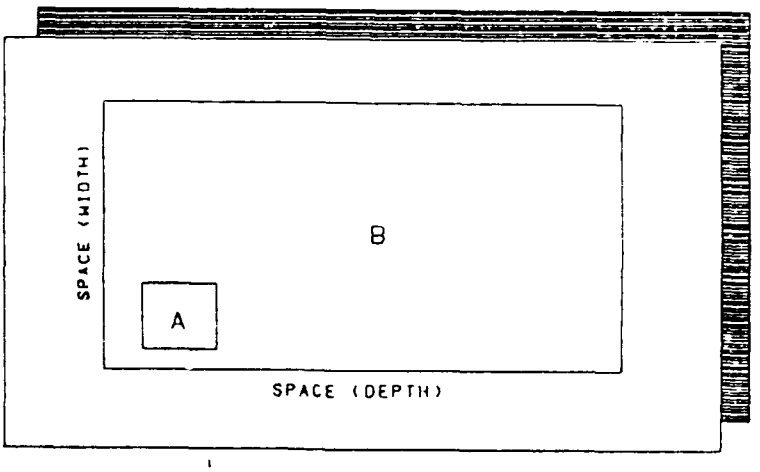


FIGURE 1: THE HISTORICAL RELATIONSHIP OF SPACE AND FORCE[9]

The relationship of time, space, and force are different for the attacker and the defender. While Clausewitz's assertion that unused time accrues to the defender may still be valid, time must also be fought for and becomes an increasingly important resource.[10] The relationship of battlefield tempo is also different for the attacker and the defender. Figure 2 shows the goals of the attacker and defender as they relate to tempo.

The offense in Figure 2 includes the offensive portion of the

defense. The defender uses concentrated firepower to attrit the attacking forces. The attrition is aimed at the disruption and disorganization of the enemy's forces in order to control the flow of the battle by creating favorable force ratios and destroying his ability to maneuver effectively. In order to control the flow of the battle the defender must slow the battle's tempo.

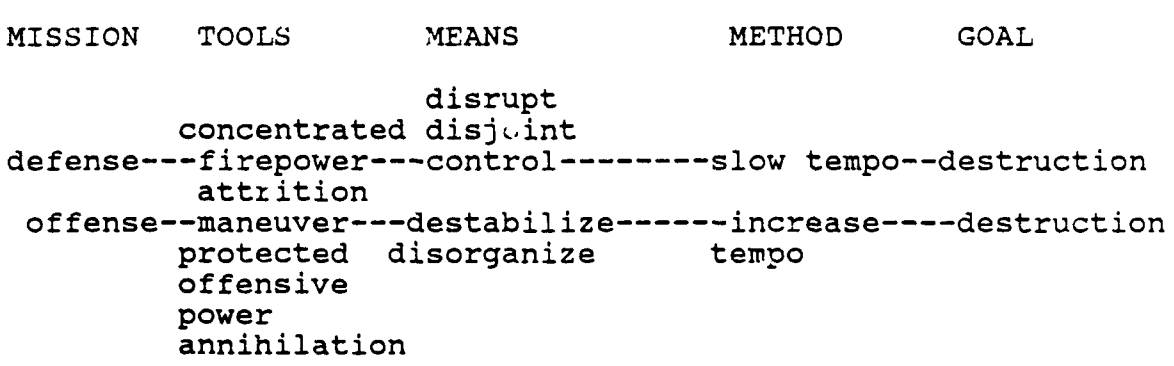


FIGURE 2: THE GOALS OF OFFENSE AND DEFENSE

The attacker uses a different method to destroy the enemy. He uses protected offensive power to facilitate maneuver, achieve annihilation, and keep the defender from defending or transitioning to the offense. Achieving conditions for annihilation of the enemy requires the destabilization and disorganization of the defense. To maximize the disruption and disorganization of the defense the attacker maintains the highest possible operational tempo. In this manner he degrades defensive tempo. That is to say, he disrupts and disorganizes the defense faster than the defender can react.

Simultaneous operations are the concentration of forces in

time to compensate for the inability to concentrate in space. Along the line of operations from the area of concentration to the final operational objective, battles and engagements are fought. "To a large extent, the duration of these battles will depend on how quickly these units can attain their assigned tactical objectives. When combined, the duration of these tactical actions will have a significant effect on the overall tempo of the operation."[11]

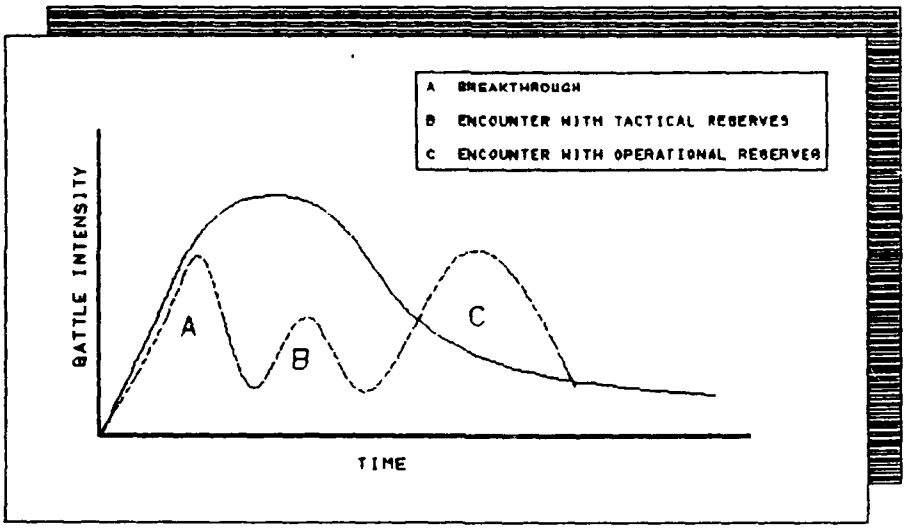


FIGURE 3: RELATIONSHIP OF TIME TO BATTLE INTENSITY.[12]

Simultaneous operations seek to compress the battles, represented by the dotted line in Figure 3, in time by attacking rapidly throughout the depths of the enemy's defenses. Optimally, the three peaks will be compressed into one peak as shown by the solid single curve. The capability to use real-time intelligence prepares the way for the rapid maneuver of forces and fires through the depths of the enemy's defenses.

The compression of battles in time to a single violent peak is perhaps achievable only in theory. If it is possible at all, it would be accomplished using strategic surprise coupled with nuclear weapons or perhaps through the "near nuclear" effects of modern munitions.[13] It does provide a rationale for the importance of synchronization, however.

Attacks by fire only in the depths of the enemy's defenses achieve only temporary advantages unless they desynchronize the enemy's forces through the destruction or disruption of a battlefield operating system or operational function (i.e. air force). In any case decisive success can only be achieved when firepower is combined with maneuver. The tempo of the maneuver force is a critical element of success. The attacker tries to raise the operational tempo as high as possible while the defender tries to slow or control the tempo of the battle in order to create the favorable correlation of forces needed for successful transition to offensive operations.

"Tempo, or more precisely tempo of execution, is nothing more nor less than operational rate of advance."[14] It applies to offensive action both by the attacker and the offensive element of the defense. Also inherent in tempo is the application of combat power. The ability to achieve superior combat power at the decisive place and time is critical to the maintenance of tempo. The direction or line along which the force is applied is key to maintaining favorable correlations of forces and attainment of

decisive points. On the extended battlefield, tempo is an essential element of success. The World War One battlefields of France were tied to the endurance and speed of the individual soldier, and many times supporting fires and logistics could not support more than a limited advance because the ground and roads were turned into quagmires.

> The two German operational offensives of the First World War (in 1914 and 1918) had only just failed to achieve a decision. And they had evidently failed because their overall tempo was too slow. The punches were telegraphed in preparation and laboured in execution; as a result, the defender, despite his own sluggishness, was able to block them."[15]

Technology provided the solution to increase protection and tempo of operations thus restoring mobility to the battlefield. Mechanization, aircraft, and radios provided the tools to significantly increase the tempo of operations through the combination of concentric and irruptive maneuver. The tempo of operations in Poland, 1939 and France, 1940, are a shocking contrast to the tempo of operations in World War One. An operational tempo higher than the defender can accommodate will in itself cause disruption and disorganization. The defender will be forced to commit any forces available to buy time to maintain the coherence of his defense. Compared to a concentrated, synchronized reaction, this piecemeal commitment of forces makes it easier for the attacker to maintain superiority at the decisive point. The higher the tempo of operation the less time is available for action. Windows of opportunity for offensive

transitions get smaller and the importance of minutes and seconds increases.

Figure 4 describes the relationship of tempo and time. The importance of the relationship is the opportunity for action afforded to the antagonists. The higher the tempo the less time an opponent has to react. The slower the tempo the more time an opponent has to react and execute effective counter operations. In other words tempo determines the size of windows of opportunity.

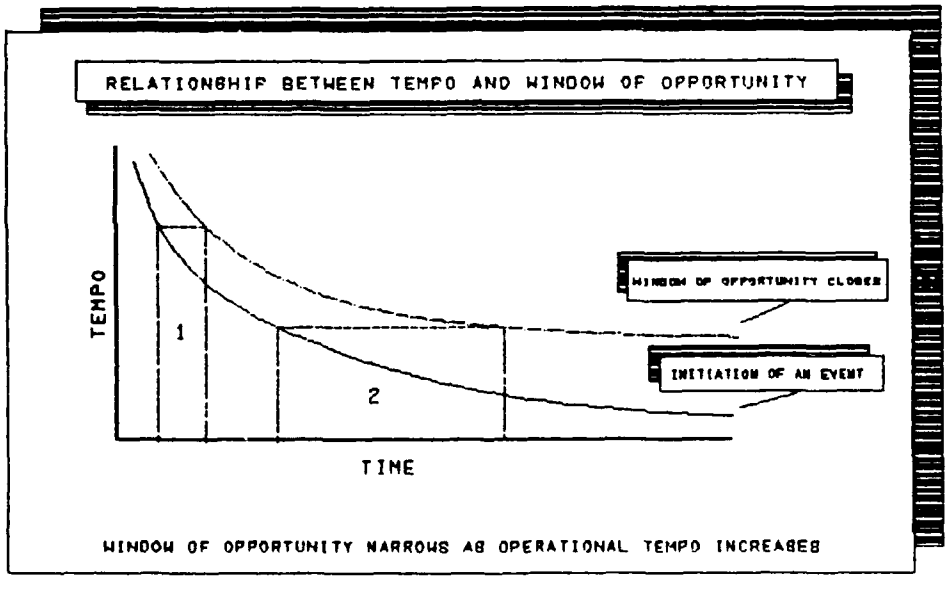


FIGURE 4: THE RELATIONSHIP OF TEMPO AND TIME[16]

If an opponent is normally capable of operating at tempos associated with Block One, the goal of deep and simultaneous operations is to force him to operate at a lower tempo of operation such as Block Two. A significant advantage can be

gained by maintaining a high operational tempo while slowing the enemy's tempo. By maintaining a higher operational tempo than the enemy several actions can be accomplished before the enemy can react. The disruption of command and control, fire support, and reserves are some of the actions that will reduce an opponent's tempo of operation.

Higher tempos of operation require units capable of operating in narrower windows of opportunity. Surprise and possession of the initiative also have an impact on the relative size of the windows of opportunity. The opponent with the initiative will normally cause, or be capable of acting at, the beginning of an opportunity window. The size of the reacting opponent's window of opportunity is a function of his ability to anticipate and improvise through the use of branches and contingency plans. The ability to act in a given window of opportunity is primarily a function of intelligence and agility of the force. The reacting opponent must go through the OODA loop (Observe, Orient, Decide, Act) before he can take advantage of the time available in a window of opportunity. Surprise further decreases the time available in a window because it delays OODA loop initiation through its impact morally, cybernetically, and physically. The relative time available in a window of opportunity is demonstrated graphically by the bars in Figure 5.

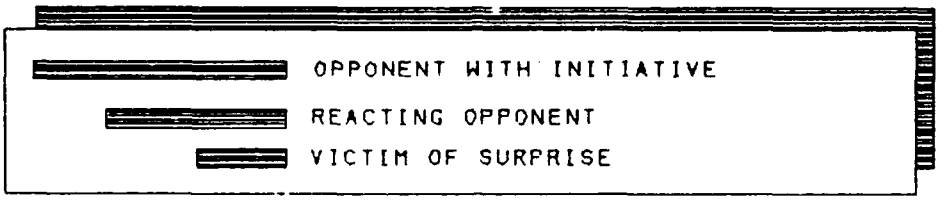


FIGURE 5: THE RELATIONSHIP OF SITUATION TO THE RELATIVE SIZE OF WINDOWS OF OPPORTUNITY.

The size of a window of opportunity can be enlarged by reducing the time required to execute the OODA loop. Contingency plans, branches, and drills are examples of techniques which can be used to increase the time available for action or reduce reaction time. To execute these techniques, and concurrently achieve higher operational tempos, requires more agile units and organizations. Anticipation and improvisation are essential to operations at or against high tempos of operation. The attacker must have an organization capable of acting at the greatest possible velocity. The defender must use all means possible to slow and preferably control the enemy's tempo in an order to gain time to establish a favorable correlation of forces at the decisive point.

The defender for his part must rely on high transitional velocity, the speed at which he can transition from the defense to the offense. If the defender is forced to commit forces piecemeal in an effort to gain time it is to the advantage of the attacker. A maxim underlying Jomini's fundamental principle of war is, "To maneuver to engage fractions of the hostile army with the bulk of one's forces."[17] The opponent who can operate faster is the one

who has the best opportunity to dictate the tempo. The ability to dictate the tempo of operations combined with superior agility will facilitate the gaining and maintenance of the initiative. Initiative is the freedom to act.

Agility is the ability to change direction in response to a changing situation and "to act faster than the enemy [which]...is the first prerequisite for seizing and holding the initiative."[18] Acting faster than the enemy allows us to operate at higher tempos and, therefore, in narrower windows of opportunity.

> Such greater quickness permits the rapid concentration of friendly strength against enemy vulnerabilities. This must be done repeatedly so that by the time the enemy reacts to one action, another has already taken its place, disrupting his plans and leading to late, uncoordinated, and piecemeal enemy responses. It is this process of successive concentration against locally weaker or unprepared enemy forces which enables smaller forces to disorient, fragment, and eventually defeat much larger opposing formations.[19]

As FM 100-5, Operations, states: "Agility is as much a mental as a physical quality."[20] The leader--supported by the cybernetic structure which transmits his will and the physical structure which executes it--provides the mental quality. His mental flexibility, ability to read the battlefield, make good decisions based on limited information, and think on his feet all contribute to agility.[21] The ability of the organization to anticipate, improvise, collect, process, and act on information contribute to the agility of the cybernetic structure. The physical aspects of agility are found in the equipment, organization, communications, and logistical organization of the military instrument.

At the tactical and operational levels the ability to move forces, concentrate combat power at decisive points, maintain support, and execute effective command and control are all essential for achieving victory. The degree to which a commander can accomplish these tasks is a function of resources and freedom of action.

Land battles are fought in the mediums of the air and ground. Each has an impact on the other. Control of the air is essential to freedom of action on the ground. Air defenses can protect a force but they do not substitute for control of the air. On the ground freedom of action is affected by the enemy terrain, weather, and friction. An operational and tactical commander uses airpower, firepower, and maneuver to restrict his adversary's freedom of action through close and deep operations.

A commander often must fight for freedom of action since his opponent will try to deny it to him. The struggle for freedom of action in the air is embodied in the air campaign. The struggle for freedom of action on the ground is embodied in the development of plans which synchronize multiple operating systems, arms, and services. In both mediums, freedom of action is critical to the ability to maneuver. One of the key aims of battle is to disrupt, destroy or neutralize the enemy's ability to restrict our freedom of action.

Advances in technology have made achieving freedom of action more complex and difficult. Possession of freedom of action,

especially when the enemy is denied it, provides a commander with a significant advantage. For these reasons it is essential that:

> At both levels [operational and tactical], the principal targets of deep operations are the freedom of action of the opposing commander and the coherence and tempo of his operations.[22]

Freedom of action is not all the commander needs. He also needs an instrument capable of achieving a decision. On a battlefield characterized by simultaneous operations throughout the depths of friendly and enemy areas of operation, an agile force capable of synchronizing friendly action, while desynchronizing the enemy, will be capable of seizing the initiative and establishing the conditions for victory. Current technology provides the capability to link accurate and lethal fires to real-time intelligence. This poses significant problems--as well as significant capabilities--for the maneuver forces.

An important aim of the air campaign is gaining air superiority. This has traditionally been almost exclusively an air force operation. Aircraft, tactical ballistic missiles, drones, remotely piloted vehicles, air defense artillery, and surface to air missiles, provide the means necessary for maneuver, fires, and protection in the air medium. To maintain effective control of the air, and protect the maneuver force on the ground, there must be a strong link between air force, air defense, and fire support.

Air power provides the operational commander with a

significant capacity to apply fires in his area of operations. Aircraft can go great distances in short periods of time. That gives the operational commander the ability to achieve surprise and rapid concentration of effort. They have greater flexibility than other fire delivery means, but require more mission planning and coordination time. With air superiority, an advantage in use of time, speed, and range of operations develops for one combatant. Although difficult to adjust rapidly to mission changes, air power is a primary operational means of delaying, disrupting, diverting, and destroying forces on the battlefield. It is also a means of reconnaissance.

As the range of delivery systems increases, targets once vulnerable only to air power become vulnerable to ground launched fires. This does not mean that these fires will replace air power. They can, however, cooperate with air power; and by doing so, make air power both more effective and more survivable. To increase aircraft survivability and effectiveness, closely coordinated ground fires can suppress air defense systems and networks (Suppression of Enemy Air Defense or SEAD) and, to some degree, disrupt and destroy airfields and support facilities.

Success in the air dimension requires a centralized targeting system able to coordinate operations in two time frames. In one time frame the system uses real- or near real-time intelligence for command and control, and the immediate attack of critical targets.[23] In the other, it consolidates all available

intelligence over time, builds a deliberate picture of the enemy in order to locate high pay off targets and key C^3I nodes, then applies the best available resources (air delivered or ground launched) to achieve desired results.

A relative balance between maneuver, firepower, and protection is essential to mobility on the battlefield. Victory requires that forces first reach the point of decision and then maintain a favorable correlation of forces at that point. Mobility is essential to ground success; History has illustrated this point many times. Two examples demonstrate the point. The tank was developed to restore mobility to the World War One battlefield and combined arms formations were reintroduced in Israeli doctrine after Egyptian anti-tank missiles stopped pure tank units.

Mobility on the ground depends to a large degree on the freedom of action in the air. It is worth noting Rommel's assessment of British command of the air and its effect on ground operations prior to the battle of Alam Halfa.

> From the command point of view he would gain the following advantages:
>
> a) Through his total command of the air, he alone would have access to complete and unbroken reconnaissance reports.
>
> b) He would be able to operate more freely and boldly, since he would be able, by use of his air-power, to break up the approach march and assembly and indeed every operation of his opponent, or alternatively delay them until he himself had had time to take effective counter measures.
>
> c) As a general rule, any slowing down of one's own operations tends to increase the speed of the enemy's. Since

> speed is one of the most important factors in motorised warfare, it is easy to see what effect this would have.[24]

An important element of mobility is the commander's freedom of action. Freedom of action on the ground is attained by successful synchronization of battlefield operating systems. The systems--aviation, maneuver, engineer, fires, combat service support, air defense, intelligence and electronic warfare, and command control and communications--provide the means for mission accomplishment. An important element not associated with tempo or battlefield operating systems is unconventional warfare. Unconventional warfare can have a significant impact on freedom of action. Examples of this are: Lawrence of Arabia's actions around Deraa to prevent Turkish reinforcements from reaching the battle area and partisan warfare in Russia which drew forces away from the front, cut down resupply, and destroyed critical material.

Battlefield operating systems provide the means to protect and to strike. They protect by preventing enemy battlefield operating systems from affecting friendly freedom of action. They strike by destroying the enemy's capability to restrict friendly freedom of action. Striking battlefield operating systems was probably first accomplished by doing such things as "silencing enemy batteries" to facilitate maneuver. Technological advances and expanded time and space factors have made this task more complex. For example, prior neutralization of enemy air forces

became almost a prerequisite for successful major operations in World War II.

Attacking battlefield operating systems requires timely, detailed information combined with fires and/or maneuver. The effect of disruption, destruction, or neutralization of a battlefield operating system has a significant impact on battlefield mobility and the projection of combat power. The 1967 Arab-Israeli war began with an Israeli air force strike on Arab air forces. Those forces were effectively neutralized. In the same war, an airmobile cperation, synchronized with artillery, destroyed an Egyptian artillery group capable of disrupting the rapid advance of an Israeli division.[25] In 1982 the Israelis preceded their ground attack in the Bekaa Valley with an assault which crippled Syrian air defenses. By decisively crippling the Syrian air defense operating system the Israelis ensured their air force could support ground operations effectively.[26] More recently, in Afghanistan the Stinger missile helped create conditions which facilitated ground operations by forcing Russian aircraft and helicopters to change their tactics.[27]

The maintenance of freedom of action in the air and on the ground is essential for mobility. We must have the capability to prevent or limit enemy efforts to restrict our freedom of action. The disruption, destruction or neutralization of one battlefield operating system may be enough to ensure mobility--as was the case in the examples cited.

Precision guided munitions, brilliant munitions and remotely delivered mines have the potential to constrain maneuver. Linked to real-time or near real-time intelligence the impact of firepower on the ability to maneuver will be significant.

> The first problem in tactics should be this: how a given number of men ought to be ranged so that they may move and act with the greatest velocity; for on this chiefly depends the success of all military operations.
>
> An army superior in activity can always anticipate the motions of a less rapid enemy, and bring more men into action than they can in any given point, though inferior in number. This must generally prove decisive, and ensure success.[28]

The goal of the attacking force is the disruption, disorganization, and destruction of the defender's forces in order to seize a decisive point which will help to secure victory. A question which must be solved is how to achieve the greatest velocity and striking power of a maneuver force.

> At tactical level, the dynamic element of manoeuvre theory (the velocity component of momentum) is represented by rate of advance, at operational level by the more complex concept of tempo. Like rate of advance, tempo is expressed in kilometres per hour or per day, but it represents the total distance from initial concentration area to final operational objective divided by the time from receipt of orders by the executing formation to accomplishment or abandonment of its mission.[29]

Articulation of organizations, or for lack of a better term, the use of forward detachments and operational maneuver groups, will help increase the rate of advance and tempo of operations. At the tactical level forward detachments can seize geographical objective points (bridges, transportation nodes, key or decisive terrain) or objective points of maneuver (for example, enemy LOCs or key command and control elements). Forward detachments may

also cause the premature deployment and concurrent attack of reserves. Finally, the use of reserves against the forward detachment will prevent their timely use against the main enemy body.

At the operational level, operational maneuver groups accomplish the same functions in the operational depths. A fire system (including aviation and aircraft) which complements the operational maneuver group will be needed to accomplish the same functions as the fire system at the tactical level for the forward detachment. The tactical and operational fire systems facilitate a decrease in size of organizations acting in these roles.

The use of air mechanization can also increase the potential tempo of an organization. A noted proponent of air mechanization, Richard Simpkin, recommends a combination of air mechanized and ground maneuver forces for increased rates of advance. His concept, described as the " Lance, hammer, and dozer blade",[30] consists of three parts. The "lance" is an air mechanized and/or a ground force which is extremely agile and capable of high rates of advance. It acts as an awl, rapidly finding the path of least resistance for the leading ground forces. The "hammer" is a mobile tank heavy force for irruption of the defenses. The "dozer blade" is a mechanized heavy holding force to secure and exploit the successes of the first two components. When the three are combined they create a powerful, agile force capable of high tempos of operation.

As noted in the discussion of tempo, a maneuver force capable of operating in narrow windows of opportunity provides significant advantages. By acting more quickly than the enemy can react, he is denied time. His attempts to regain it often leads to the premature or piecemeal commitment of his forces. As a result the enemy has lost agility.

Agility can be increased through the articulation of unwieldy organizations, reduction in the number of command echelons,[31] and the use of air mechanization.[32] Any of these methods can save time; the most valuable of battlefield commodities.

Just as the articulation of an unwieldy organization can improve its potential tempo, it can also improve the organization's agility. The ability to shift directions quickly requires knowledge of enemy dispositions and a force flexible enough to accommodate changes. To some degree, that flexibility is dependent on size. A large formation, such as a corps, is not as responsive to changes in direction as a brigade or division. When a formation is articulated, a smaller force capable of quickly changing direction leads the larger force. The flexibility of the smaller force gains more time to accommodate a change in direction by the larger force.

Another method of improving the agility of a formation is to reduce the number of command echelons. The problem is described by Basil H. Liddell Hart. He says:

> The number of command echelons must be reduced. Each added link in the chain of command causes problems. Each tends to delay transmission of orders forward and getting information back. And, each added link tends to weaken the commander's power by providing him with a more remote picture of the situation and also by diminishing the force of his personal influence on those executing his orders. Conversely, the fewer the intermediate headquarters, the more dynamic operations tend to become.[33]

One option to address this problem is the elimination of current brigade or division headquarters. Replacing current units with either smaller divisions or slightly larger brigades would eliminate one echelon of command and thereby increase speed and flexibility.[34]

Air mechanization is a third method of enhancing agility. Helicopters and remotely piloted vehicles can move several orders of magnitude faster than ground maneuver systems. This capability can gain time for ground maneuver forces to react to changing situations. They are capable of providing both timely intelligence and arriving at the decisive point quickly.

In the future, as in the past, agility will remain key to freedom of action. The Soviets hope to achieve freedom of action by combining real-time intelligence with fires to support tactical and operational maneuver. D. L. Smith and A. L. Meier's description of this idea is instructive:

> By the 1990's, the concepts of 'reconnaissance fire complex' (RFC) at the tactical level, and reconnaissance strike complex (RSC) at the operational art level will be, in the words of Lieutenant General V.G. Reznichenko, the author of the 1985 Soviet bible, Taktika, 'one of the most important elements in securing real-time reconnaissance information and destroying, with high accuracy means, enemy targets.'
> Together, the RSC and RFC form a 'reconnaissance

> destruction complex' consisting of command and control, target acquisition (the 'reconnaissance' portion) and weapon systems. The RFC will generally be employed at division level and destroy 'by fire' from tube artillery and multiple rocket launchers. The RSC is an Army/Front grouping with a much greater variety of target acquisition means and employing the destructive capability of very long-range artillery, fixed or rotary-wing aircraft, or operational/tactical missiles.[35]

The Soviets anticipate the RSC and RFC will give them the capability for deep operations by fire. It will be their primary means of restricting an opponent's freedom of action and facilitating their own. Both tasks are accomplished using the same methods; the destruction, disruption, or neutralization of enemy battlefield systems potentially able to restrict their own freedom of action or to restrict their enemy's freedom. The concept is, of course, equally applicable on our side.

The attack on a battlefield operating system, even a localized one, or the disruption, destruction or neutralization of enemy defenses in depth will require a significant number of reconnaissance and delivery systems linked to an effective command and control system. A shortage of resources probably means one will be unable to gain complete freedom of action. That makes it necessary to key the attacks on specific systems for specific purposes. They must use available arms and be synchronized to achieve the greatest effect. For example, the tremendous firepower of Soviet Army artillery can disrupt defenses or disorganize attacks. To facilitate freedom of action the neutralization or destruction of the artillery may be necessary. The attack on this system should not be the sole responsibility of

artillery, but should be a synchronized effort using available reconnaissance and fire assets (including aviation, air force, and electronic warfare means) and when possible combined with maneuver for a more decisive effect. The command and control links and nodes might be the specific target selected for attack since it is vulnerable and its destruction would disrupt the total battlefield operating system.

An attack against a battlefield operating system may also be conducted to facilitate a synchronized attack against another system. For example, the destruction or disruption of the enemy's air defenses might be part of a synchronized attack against indirect fire systems supporting an enemy main attack.

Successful execution of this concept demands that intelligence collection assets and fire delivery systems be organized into "reconnaissance-fire/strike complexes". The complexes would synchronize intelligence collection, fires, aircraft, and maneuver as well as exploit the capability to link real- or near real-time intelligence linked to responsive fires. They would also simplify the synchronized attack on enemy battlefield operating systems. The disruption or destruction of an enemy artillery group or the air defenses protecting the artillery groups could possibly be accomplished through such a strike. It would be particularly effective when combined with maneuver. The disruption or destruction of large groupings of enemy artillery just prior to an attack or counterattack would

increase the chances of success. During the assault a synchronized succession of strikes to delay or disrupt enemy reserves would create favorable terms for the close battle.

A primary role of deep operations is to set favorable conditions for the close battle. The disruption or destruction of enemy reserves and key battlefield operating systems sets favorable conditions for high rates of advance and in turn a high tempo of operations. This is possible through the attack of enemy battlefield operating systems using simultaneous operations to paralyze his defense while the maneuver force shatters it through a series of rapid, powerful, and well timed blows seizing decisive points in his rear. One of the key elements in this concept is the delivery of fires. The effectiveness of that element of combat power is, to a large degree, hostage to new technologies.

III. FIREPOWER

> Firepower provides the destructive force essential to defeating the enemy's ability and will to fight. Firepower facilitates maneuver by suppressing the enemy's fires and disrupting the movement of his forces....Current weapons and means of massing fires make firepower devastatingly effective against troops, materiel, and facilities in greater depth and accuracy and with more flexibility than ever before.[36]

Firepower affects tactical and operational maneuver. "Tactical leaders must understand the techniques of controlling and integrating fire, maneuver, and protection, coordinating direct and indirect fires, utilizing air and naval fires and

substituting massed fires for massed troops."[37] At the operational level of war "Firepower supports friendly operational maneuver by damaging key enemy forces or facilities, creating delays in enemy movement, complicating the enemy's command and control, and degrading his artillery, air defense, and air support. At the operational level, firepower can also disrupt the movement, fire support, command and control, and sustainment of enemy forces."[38]

Firepower can be used to facilitate or deny maneuver. Delivering fires and mines accurately into the depths of the enemy defenses can disrupt or destroy enemy fire delivery systems and command and control as well as deny, delay, divert, or disrupt the shifting or moving of enemy forces. The same fires that deny the enemy the ability to maneuver, control, and fire can facilitate friendly maneuver. The enemy can be expected to possess this capability as well. This means that one aspect of the battle at the operational and tactical level will be focused on attacking the enemy's ability to restrict our freedom to act. Air campaigns and counterbattery fights are examples of this type of attack.

Technological advancements, such as RPVs and accurate electronic collection means, have expanded the capability to link real-time intelligence to fire support. Such a combination proved its effectiveness in the Bekaa Valley in 1982 when Israel used aircraft, drones, electronic intercept, and remotely piloted vehicles to strike a decisive blow against the Syrian air force

and air defenses.[39] The planning required detailed intelligence collected over a long period of time, however, the execution was controlled using real-time intelligence for timing, targeting, and command and control. Combining real-time intelligence with long range weapons using precision guided, brilliant, and remotely delivered munitions suggest that a significant potential to affect the dynamics of combat power exists. The reconnaissance destruction complex provides the cybernetic structure required to synchronize reconnaissance and precision fires in a real- or near real-time frame.

The development of precision guided munitions (PGM), brilliant munitions (BM), and remotely delivered mines combined with the capability to link their use with real- or near real-time intelligence may threaten battlefield mobility. Linking fires to real-time intelligence is not a new concept. Artillery forward observers and forward air controllers essentially provide this capability. What is different is that intelligence collected from the battlefield through electronic means or through the use of RPVs and other means can be down linked immediately to computerized command and control and fire control systems. In other words, systems can be found more reliably, attacked more precisely, and destroyed more surely. All this can be done much more quickly and with significantly fewer rounds. However, the ability to find and attack a greater number of targets will cause overall ammunition expenditure to increase.

A key aspect of the reconnaissance destruction complex is the degree to which the system must rely on the electromagnetic spectrum. The command and control and collection requirements of this system will require the freedom to act in the electromagnetic spectrum. This suggests that the reconnaissance destruction complex must not only be capable of fighting for freedom of action in the air and on the ground but in the electromagnetic spectrum as well. Ground launched anti-radiation missiles or drones will be needed to destroy enemy jammers. Remotely delivered jammers and other electronic warfare means must be fully developed and integrated into the reconnaissance destruction complex to restrict the enemy's freedom of action.

In order to facilitate mobility on the battlefield this new firepower capability can help create freedom of action by striking key elements of the enemy's reconnaissance destruction complex and battlefield operating systems. Successful execution demands, however, that the friendly force be protected.

IV. PROTECTION

> Protection is the conservation of the fighting potential of a force so that it can be applied at the decisive time and place. Protection has two components. The first includes all actions that are taken to counter the enemy's firepower and maneuver by making soldiers, systems, and units difficult to locate, strike, and destroy....The second component of protection includes actions to keep soldiers healthy and to maintain their fighting morale. It also means guarding their equipment and supplies from loss or damage.[40]

> The general's skill lies in bringing his troops close to the enemy without their being killed before beginning the attack.[41]

At the tactical level "commanders provide security against surprise maneuver, maintain camouflage discipline, fortify fighting positions, conduct rapid movements, suppress enemy weapons, provide air defense, conceal positions, deceive the enemy, and take other measures to prevent unnecessary combat losses."[42] At the operational level "...commander's take similar measures on a larger scale . They protect the force from operational level maneuver and concentrated enemy air support. Air superiority operations, theater wide air defense systems, and protection of air bases are important activities associated with maximizing combat power at the operational level."[43]

In the mid nineteenth century the arrival of the minie ball and breech loaded repeating rifle signaled a change in the nature of the battlefield. Soldiers could not face these weapons in exposed, shoulder to shoulder formations without suffering enormous casualties. They began to use the ground for protection and to move in more open formations. As increasingly lethal weapons appeared and communications improved, artillery moved off the front line, defenses increased in depth, and soldiers dispersed to reduce casualties. In World War One both sides began with linear defenses and linear attack formations. By the end of the war both used defenses in depth composed of mutually

supporting strong points and infiltration (Hutier) tactics in the attack.[44]

Historically, dispersion, armor protection, terrain shielding, speed, camouflage, and the use of limited visibility have been methods of dealing with the increasing lethality on the battlefield. These techniques will continue to be necessary in the future and will have to be improved to accommodate the new battlefield technology. We can anticipate the use of unmanned aerial vehicles (UAVs), remotely piloted vehicles (RPVs), and signal intercepts to gain the information needed for attacks on enemy forces throughout the battlefield. Those innovations make protection a key element in attempts to prevent or limit enemy efforts at delaying, disrupting, diverting or destroying our forces.

Battlefield dispersion will remain an important technique to reduce casualties. This causes a problem with maneuver and fire support. For maneuver, increased dispersion will require more time for the concentration of forces. Again, speed can compensate to a degree but limitations caused by the nature of terrain and weather put an upper limit on ground maneuver speed. Increased weapon density and longer range collection devices facilitate the rapid concentration of fires from dispersed locations, thus increasing flexibility and survivability for delivery systems. Additionally, the size of combat units and their supporting structures makes these units more difficult to move over long

distances. Other methods of protection such as increased armor, camouflage, and limited visibility are important aspects which will improve protection.

Despite dispersion on the ground, forces must maintain the capability to defend against a concentrated enemy force. Dispersed forces compensate for this through a defense in depth using air and ground launched fires synchronized with counterattacks to absorb rather than block an attack. This requires organizations that are dispersed in space but which can concentrate firepower in time. The firepower can be organic or available from higher or adjacent organizations.

Countering enemy firepower and maneuver requires a combination of active and passive measures. Real- or near real-time intelligence, combined with accurate long range fires, changes the extent and depth of both active and passive measures. Active measures which defeat or reduce the effectiveness of PGMs, scatterable mines, and false signatures is one method. Another is to attack the battlefield operating systems which must be coordinated or synchronized to provide such devastating fire. Blinding or deceiving enemy intelligence systems will further reduce the effectiveness of enemy reconnaissance destruction complex elements.

Passive means of protection will continue to be important. Camouflage and dispersion reduce vulnerability to enemy fire. The increased range and lethality of supporting fire systems helps

counteract the weaknesses previously inherent in dispersed forces. Operations during limited visibility lower the effectiveness of enemy collection systems. The increased capabilities for reconnaissance and fires place greater demands on leaders and require a cybernetic structure agile enough to fight a portion of the battle in real time as well as a portion several hours or days out.

V. LEADERSHIP

> Leadership provides purpose, direction, and motivation in combat. It is the leader who will determine the degree to which maneuver, firepower, and protection are maximized; who will ensure these elements are effectively balanced' and who will decide how to bring them to bear against the enemy.[45]

A commander's leadership is exercised through the cybernetic framework of the organization since face to face contact is not possible on a large battlefield. The availability of real-time intelligence and lethal fires that can be linked to that intelligence, require a cybernetic structure that can accommodate this need. This structure forms the framework for maneuver.

Attacking the enemy's ability to restrict our freedom of action and to limit our availability of real-time intelligence linked to fires will change the traditional time frames that commanders and staffs of divisions, corps. and armies have worked. Commanders will be more concerned with using firepower in the present to affect battles in the future than they have been in the

past. Both time frames, real- or near real-time and conventional, will be critical to the overall success of battles and campaigns.

The ability to command and control forces which are dispersed is a function of leadership and the cybernetic structure which the leader uses to command and control his organization. Only with a dramatically responsive cybernetic structure can firepower and maneuver be served in the environment characterized by real-time and near real-time operations.

The longer range of delivery systems makes units once safe "in the rear" vulnerable to attack at any time. The constant threat of attack places a constant demand on the soldiers morale. Measures to deceive and hide must be taken to reduce the possibility of detection.

The need to command and control in multiple time frames simultaneously will place more demands on the command and control structure. Fire delivery systems, intelligence, and maneuver must be synchronized to gain and maintain a high tempo while reducing the enemy's freedom of action. The current organization of operations staffs into "current operations" and "plans" cells is not fully compatible with a battle fought using real-time and near real-time intelligence. The lethality and rapidity of fire will cause an increased frequency of critical situations. These opportunities must be rapidly seized and either exploited or saved. The most responsive tool available to the commander will be ground, air, and aviation fires or electronic measures. Ground

maneuver will be comparatively slow but greater protection will increase its survivability. As new firing and command and control systems are fielded, or old ones made more responsive, the operational commander will be able to immediately influence the operation. The air tasking order's minimum 18 hour requirement will no longer limit his options.

The operational commander must be intimately involved with the struggle to gain freedom of action through the air campaign and the destruction or disruption of key enemy battlefield operating systems. The theater implication of battlefield operating systems is setting the conditions for battle.[46] Available fires and maneuver must be commanded and controlled in different time frames.

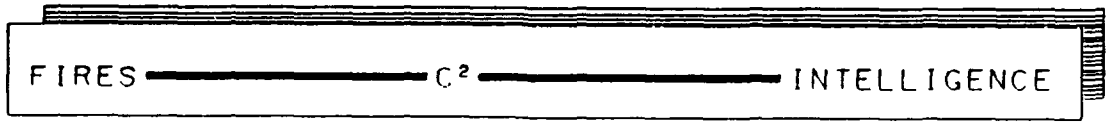


FIGURE 6: REAL-TIME OR NEAR REAL-TIME

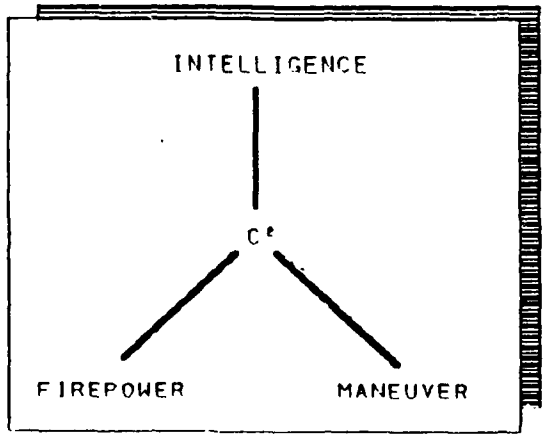


FIGURE 7: CONVENTIONAL TIME FRAME.

Figure 6 represents the time frame for command and control of a reconnaissance fire/strike complex. Figure 7 shows the conventional command and control linking intelligence, firepower, and maneuver with a focus 6 to 72 hours out. These two time frames must be used concurrently in the attack and defense in order to gain freedom of action and to obtain favorable conditions for the close battle. For example, as enemy reserves are concentrating for an attack an organized fire system can be used to disrupt preparations and force piecemeal or untimely commitment. Additionally it increases the time available to bring fires and air strikes against them.

The changing nature of time and the introduction of new technologies to the battlefield have an impact on the dynamics of combat power. Understanding the nature of the impact will help us understand how to accommodate change. We must focus on maintaining the right balance between the dynamics of combat power in order to insure mobility on the battlefield.

VI. CONCLUSIONS

Maintaining mobility on a high technology battlefield is the foundation of offensive action. It is only through offensive action that a decision can be reached, and maneuver is the means of achieving that decision. The maintenance of tempo, agility, and freedom of action--the prime components of mobility--are

essential to effective maneuver. We must organize, equip, and train our forces to be agile and capable of operating at high tempos of operation. When considering the use of air mechanized units to facilitate high tempos of operation we must be careful not to tie aviation to ground mechanization as the tank was tied to the Infantry prior to World War II.

Agility, an important element of mobility, can be improved through air mechanization, unit articulation, and reduction of command elements. The focus must be on organizing and equipping units to maintain the highest tempo possible in the attack. In the defense the focus must be on slowing the enemy's tempo and creating favorable conditions for offensive action.

Since the enemy can be expected to attempt to deny us the ability to maneuver we can anticipate the need to fight for freedom of action. The battle for freedom of action may well determine the success or failure of an operation. The attack of battlefield operating systems and the use of recon-fire and strike complexes to protect or deny maneuver will facilitate freedom of action in the air, on the ground, and in the electromagnetic spectrum. Maintaining freedom of action and a high tempo of operations requires the ability to combine real-time intelligence with responsive fires. These fires can be used to disrupt or destroy the enemy's capability to restrict our freedom of action, to create favorable conditions for the close battle, and to support rapid maneuver or deny it to the enemy.

Time, always an important quantity in war, is becoming more important to the successful conduct of operations. Time can be stolen from the enemy in the attack or defense. The fight for time is won by reducing the enemy's tempo and increasing ones own through deep operations. That fight is changing the nature of warfare.

Real-time and near real-time intelligence and the ability to link them to fires places new demands on the command and control structure. It must be able to work in closely related multiple time frames simultaneously. The planning of future actions will continue to be important but real-time intelligence linked to fires can rapidly influence the close battle or create favorable correlation of forces for the future close battle. The result may tend to centralize control of the battle. Despite the probable need to centralize control, communications systems which allow a corps commander to talk directly to a company commander can cause more problems than it solves. The trend in decentralizing command and control of the close battle will continue while centralization of the control of the deep battle will be necessary for the effective use and control of fire and strike complexes.

Time consuming staff planning procedures are becoming outdated. We must find ways to shorten the time required to execute the OODA loop. Anticipation, improvisation, contingency plans, branches, and decision support templates for both friendly and enemy forces will improve our ability to operate at high

tempos of operation. Operating at high tempos requires synchronization and agility on the part of organizations, staffs and leaders. Modifying doctrine, procedures, and organizations can reduce the time necessary to execute to OODA loop.

A cybernetic structure which unifies real-time intelligence with fires is essential to mobility on the battlefield. This capability is found in the reconnaissance destruction complexes. Combining the concept of a reconnaissance destruction complex with a complimenting maneuver organization and doctrine will provide the tactical and operational commander with the tools they need to win on a high technology battlefield.

Technology is changing the relationship of the dynamics of combat power and the way battles will be fought. Understanding these changes will help us to understand how to respond to them. Through all the changes we must understand what maneuver is and how to maintain it in the face of these changing conditions for without maneuver; there can be no decision.

ENDNOTES

1. Fuller, J.F.C., "Tactics and Mechanization", Infantry Journal, Vol. XXX, No. 5, May 1927, p. 460.

2. U.S. Army Field Manual 100-5, Operations, (Washington D.C.: U.S. Government Printing Office. May 1986), p. 11.

3. Ibid., p. 12.

4. Ibid.

5. Joseph Schroedel, "The Art and Science of Operational Maneuver". Ft. Leavenworth, Kansas, SAMS Monograph, 1988. p. 5

6. Ibid., p. 2.

7. V. Ye Savkin. The Basic Principles of Operational Art and Tactics. Washington, D.C.: U.S. Government Printing Office, 1974, p. 45.

8. Creighton W. Abrams, "Mobility Versus Firepower". Carlisle Barracks: USAWC Student Individual Study, 1 April 1953, p. 6-7. as quoted by Joseph Schroedel, "The Art and Science of Operational Maneuver". Ft. Leavenworth, Kansas SAMS Monograph, 1988. p. 3.

9. James J. Schneider, "The Theory of Operational Art", Theoretical Paper No. 3, School of Advanced Military Studies, 1 March 1988.

10. Carl von Clausewitz, On War, edited and translated by Michael Howard and Peter Paret, Princeton, New Jersey, 1976.

11. Anthony M. Coroalles, " Fighting in the Medium of Time", Fort Leavenworth, Kansas. SAMS Monograph, 1988. p. 19.

12. Ibid., p. 29.

13. D. L. Smith and A. L. Meier, "Ogarkov's Revolution: Soviet Military Doctrine for the 1990's", International Defense Review, No. 7/1987. p. 869.

14. Richard Simpkin, Deep Battle, (London: Brassey's Defence Publishers, 1987), p. 259.

15. Richard Simpkin, Race to the Swift: Thoughts on Twenty-First Century Warfare, (London: Brassey's Defense Publishers, 1985), p. 30.

16. Graphic design by Major Rick McCabe, School of Advanced Military Studies, 1989.

17. Baron De Jomini, The Art of War, Translated by G.H. Mendell and W.P. Craighill, Edited by Thomas E. Griess and Jay Luvaas, (Westport, Connecticut: Greenwood Press, 1862) p. 63.

18. FM 100-5, p. 16.

19. Ibid.

20. Ibid.

21. Ibid.

22. Ibid., p. 20.

23. MG Larsen, IDF in Leabenon, lecture notes from combined seminar, 6 January 1989.

24. Erwin Rommel, Rommel Papers, edited by B. H. Liddell Hart (New York: Harcourt, Brace and Company, 1953), p. 31.

25. Edward Luttwak, The Israeli Army, (New York: Harper and Row Publishers Inc., 1975), SAMS reprint, p. 226, 246.

26. Cobban, Helen, "The Air-Defense Lessons of the Lebanese War of June 1982. The Soviet View", Soviet Armed Forces Review Annual, Vol. 10 1985-6, p. 262-268.

27. U.S. Army Air Defense School, Memorandum for Director, DCSD, Subject: Afganistan Lessons Learned Trip, by Major William F. McManaway, 14 February 1989, p. 4.

28. J. F. C. Fuller, The Foundations of the Science of War, (London: Hutchinson and Company, 1927), p. 82.

29. Simpkin, Deep Battle, p. 54.

30. Ibid., p. 74.

31. Coroalles, "Fighting in the Medium of Time", p. 35.

32. Simpkin, Deep Battle, p. 54.

33. Basil Liddell Hart, "How to Quicken Maneuver and Gain Flexibility," unpublished and undated manuscript provided by the "Art of War Colloquium", U.S. Army War College, Carlisle Barracks, Pa., p. 1. as quoted by Coroalles, "Fighting in the Medium of Time", p. 35.

34. Ibid.

35. D. L. Smith and A. L. Meier, "Ogarkov's Revolution: Soviet Military Doctrine for the 1990's". p. 871.

36. FM 100-5, 12.

37. Ibid.

38. Ibid., p. 13.

39. Cobban, Helen, "The Air-Defense Lessons of the Lebanese War of June 1982. The Soviet View", Soviet Armed Forces Review Annual, Vol. 10 1985-6, p. 262-268.

40. FM 100-5, p. 13.

41. Frederick the Great, as quoted by Shelford Bidwell and Dominick Graham, Fire-Power, (London: George Allen and Unwin, 1982). p. 282.

42. FM 100-5 p. 13.

43. Ibid.

44. Shelford Bidwell and Dominick Graham, Fire-Power, (London: George Allen and Unwin, 1982). p. 116-130 and Timothy T. Lupfer, "The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War", Leavenworth Papers No. 4, (Combat Studies Institute, USACGSC, Fort Leavenworth Ks) p. 31-54. These two books provide an insightful account into the evolution of British and German tactics in World War One.

45. FM 100-5, p. 13.

46. Examples of battlefield operating systems setting the terms of battle are the obstacle belts at Kursk or Torres Vedres and Soviet artillery offensives of World War Two.

BIBLIOGRAPHY

Books

Barker, A.J., Six Day War, New York: Ballantine Books, 1974.

Bellamy,Chris, The Future of Land Warfare, New York: St. Martins Press, 1987.

Bidwell, Shelford and Graham, Dominick, Firepower: British Army Weapons and Theories of War 1904 - 1945, London: George Allen and Unwin Ltd., 1982.

Bloch, Marc, Strange Defeat, London: W. W. Norton and Company, 1968.

Colby, Elbridge, Masters of Mobile Warfare, Princeton, New Jersey: Princeton University Press, 1943.

Dupuy, Trevor N., The Evolution of Weapons and Warfare, New York: The Bobbs-Merrill Company, 1980.

_____., Numbers, Predictions and War: The use of History to Evaluate and Predict the Outcome of Armed Conflict, Fairfax, Virginia: HERO Books,1985.

_____., Understanding War: The History and Theory of Combat, New York: Paragon House Publishers, 1987.

Fuller, J. F. C., Armored Warfare, Westport Connecticut: Greenwood Press, 1983.

_____., The Foundations of the Science of War, London: Hutchinson and Co., 1927.

Gabriel, Richard A., Operation Peace for Galilee, New York: Hill and Wang, 1985.

Jomini, Antoine, The Art of War, Translated by G.H. Mendell and W.P. Craighill, Edited by Thomas E. Griess and Jay Luvaas, Westport, Connecticut: Greenwood Press, 1862.

Liddell Hart, Basil H., The Other Side of the Hill, London: Cassell and Company, 1970.

Luttwak, Edward, and Horowitz, Dan, Israeli Army, New York: Harper and Row, 1975, SAMS Reprint.

Rommel,Erwin, The Rommel Papers, edited by Basil H. Liddell Hart, New York: Harcourt, Brace and Company, 1953.

Simpkin, Richard, Race to the Swift: Thoughts on Twenty First Century Warfare, New York: Pergammon Press, 1986.

_____., Deep Battle: The Brainchild of Marshall Tukhachevskii, New York: Pergammon Press, 1987.

Triandafillov, V., Nature of the Operations of Modern Armies, Moscow: 1929, SAMS reprint, 1988.

Tukhachevskii, Mikhail, New Problems in Warfare, U.S. Army War College reprint, November 1983.

Von Clausewitz, Carl, On War, edited and translated by Michael Howard and Peter Paret, Princeton, New Jersey, 1976.

Zohdy, Mohammed Dia El Din; Badri, Hassan El; and Magdoub, Taha El, The Ramadan War, 1973, Dunn Loring, Virginia: T. N. Dupuy Associates, 1979.

Periodicals and Articles

Bellamy, Chris, "Soviet Artillery and Missile Force Challenge, International Defense Review, No. 4 1988.

Berry, F. Clifton, "Destroying Enemy Armor", Airforce Magazine, April 1989.

Brower, Kenneth S.,"Fuel-Air Explosives: A Blow to Dismounted Infantry", International Defense Review, No. 10, 1987.

Brown, Charles E., "Smart Munitions for the Modern Battlefield", Journal of Electronic Defense, September 1988.

Burke, Col. John T., "The Firepower Revolution", Army Magazine, November 1988.

Claunch, Jim L., "Deep Battle Lance: A Nonnuclear Doctrinal Primer", Field Artillery Magazine, August 1987.

Cobban, Helen, "The Air-Defense Lessons of the Lebanese War of June 1982: The Soviet View", Soviet Armed Forces Review Annual, Vol. 10 1985-6.

Dick, C.J., "Soviet Operational Art: Part 2: The Keys to Victory", International Defense Review, No. 8 1988.

Doyle, James S., "Shadow of War", Army Times, 15 August 1988.

Farndale, General Sir Martin, "Follow on Forces Attack", Nato's Sixteen Nations. April/May 1988.

Fuller, J.F.C., "Tactics and Mechanization", Infantry Journal, May 1927.

_____., "The Master Weapon and Its Influence on Tactics", Army Quarterly, August 1942.

Gershanoff, Hal, "Smart USAF Weapons Get Smarter", Journal of Electronic Defense, September 1988.

Hewish, Mark and Robert Salvy, Bill Sweetman and Gerard Turbe, "Reconnaissance and Combat Drones", International Defense Review, No. 10 1987.

Holcomb, James F. and Graham H. Turbiville, "Soviet Desant Forces: Broadening the Desnat Concept", International Defense Review, No. 10 1988.

Holder, L.D., "Maneuver in the Deep Battle", Military Review, May 1982.

Kennerich, Manfred, "The MLRS - Phases II and III: New Dimensions in Conventional Defence", Nato's Sixteen Nations, April/May 1988.

Northrup, Timothy J., "RPV: Above the Threat", Field Artillery Magazine, February 1988.

Ogorkiewicz, R. M., "Countermeasures for Tanks: Beating Smart Munitions", International Defense Review, January 1989.

Pengelly, Rupert and Gerard Turbe, "Artillery Fire Control: New Computer Systems Improve Guns Effectiveness", International Defense Review, August 1988.

Poyer, Joe, "Remotely Piloted Vehicles, Drones, Decoys, and Snoops", ICA, May 1988.

Rittenhouse, Bill, "MLRS Smart Munitions", Field Artillery Magazine, August 1987.

Sanderson, Kent S., "Joint STARS Looks Deep to Win", Field Artillery Magazine, February 1988.

Schneider, Wolfgang, "Soviet Army Air Defense: Effectiveness Through Numbers", International Defense Review, March 1989.

Sidorenko, A., "Development of the Tactics of Offensive Battle", Soviet Military Review, October 1979.

Steere, MG Richard E., USAF, "Tomorrow's Weapons - Not Just Smart, They're Brilliant", Journal of Electronic Defense, September 1988.

Sweetman, Bill, "Airborne Reconnaissance Radars", International Defense Review, September 1987.

Sweetman, Bill, "MLRS to Launch New Weapons", International Defense Review, November 1987.

Wilson, Thomas G., "Lance: Two New Concepts for Modern Fire Support Doctrine", Field Artillery Magazine, August 1987.

Government Publications

Airland Battle-Future (Heavy) 2004, Revised Final Draft, US Government Printing Office, 9 February 1989.

Field Manual 100-5, Operations, Washington, D.C.: US Government Printing Office, May 1986.

Manuscripts and unpublished papers

Coroalles, Anthony M.,"Fighting in the Medium of Time: The Dynamics of Operational Tempo", School of Advanced Military Studies, Ft. Leavenworth Kansas, 11 April 1988.

Gawrych, George, "The Israeli Path to the Operational Art of War: Division Operations at the '56 and '67 Battles of Abu Ageila", Combat Studies Institute, SAMS reprint 1988.

Lupfer, Timothy T., "The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War", Leavenworth Paper No. 4, Combat Studies Institute, US Army Command and General Staff College, Fort Leavenworth, Kansas, July 1981.

Schneider, James J., "Theoretical Paper No. 3: The Theory of Operational Art", School of Advanced Military Studies, 1988.

Schroedel, Joseph, "The Art and Science of Operational Maneuver", School of Advanced Military Studies, 2 May 1988.

U.S. Army Air Defense School, Memorandum for Director, DCSD, Subject: Afganistan Lessons Learned Trip, by Major William F. McManaway, 14 February 1989.